Remarks

Restriction

The telephone election of Group II, claims 32-52 is confirmed. Non elected claims 1-31 have been canceled.

Rejections Under 35 USC §112

Claims 39 and 46-52 have been rejected under 35 USC §112, second paragraph, because of the recitations "the solder ball" in claim 39, and "the external contact" in claim 46. In response to the 35 USC §112 rejections, claim 39 has been amended to remove "the solder ball" recitation. In addition, claim 46 has been amended to remove "the external contact" recitation.

Rejections Under 35 USC §103(a)

Claims 32-40 and 46-52 have been rejected under 35 USC §103(a) as being unpatentable over Abe et al. (US Patent No. 6,402,013) in view of Glenn et al. (US Patent No. 5,482,736).

Claims 41-45 have been rejected under 35 USC §103(a) as being unpatentable over Abe et al. (US Patent No. 6,402,013) in view of Soderlund et al. (US Patent No. 5,611,,476) and Glenn et al. (US Patent No. 5,482,736).

In response to the 35 USC §103 rejections, independent claims 32, 41 and 46 have been amended. In addition, the Examiner is asked to consider the arguments to follow.

Summary of the Invention

Rejected claims 32-40 and 46-52, and added claims 53-57, are directed to a "system 62 (Figure 5A) for bonding external contacts (solder balls 44) to contact pads 42 on semiconductor components 28". As shown in Figure 5A, the system 62 includes a "polymer flux" (flux droplet 42), and a "flux dispensing mechanism 68" configured to deposit the polymer flux onto the contact pads 42. As shown in Figure 2B, the "polymer flux" includes a "polymer resin"

configured for deposition by the mechanism 68 on the contact pads 42 as a viscous non-flowing droplet. As shown in Figure 2C, the polymer flux is able to support and electrically insulate the external contacts (solder balls 44) on the contact pads 42 for bonding. The "polymer flux" also includes a "fluxing agent" in the "polymer resin" configured to clean the contact pads 42, and a "curing agent". As shown in Figure 2D, the "curing agent" is configured to cure the "polymer resin" on the contact pads 32 into a "polymer support member 46" for each external contact (solder ball 44).

As shown in Figure 5A, the system 62 can also include a "placement mechanism 72" configured to place the "external contacts" (solder balls 44) on the droplets and the contact pads, and a "furnace 74" configured to reflow bond the "external contacts" (solder balls 44) to the "contact pads 32" and to heat the "polymer flux" for curing.

Rejected claims 41-45, and added claims 58-62 are directed to essentially the same system but with the "polymer flux" including "a plurality of solder particles in the polymer resin" configured to "coalesce into a solder bump 48 (Figure 4C)".

35 USC §103 Rejections Of Claims 32-40 and 46-52 Over Abe et al. and Glenn et al.

With respect to the rejections of claims 32-40 and 46-52, the cited combination of Abe et al. and Glenn et al. does not disclose all of the limitations of amended independent claims 32 and 46. In addition, the cited combination does not disclose all of the limitations of added independent claim 53.

In particular, amended independent claim 32 recites "a polymer support member on each contact pad comprising a cured droplet of the polymer flux supporting an external contact". Amended independent claim 46 recites "a polymer

support member on the contact pad comprising cured polymer resin in the droplet having a thickness which is less than the diameter of the solder ball". Added independent claim 53 recites "a donut shaped polymer support member on the contact pad encompassing a base of the solder ball, the member comprising cured polymer resin in the droplet". Antecedent basis for this recitation is contained on page 12, line 32, to page 13, line 7 of the specification. Added independent claim 53 also recites "a placement mechanism configured to push the solder ball through the droplet into contact with the contact pad". Antecedent basis for this recitation is contained on page 11, lines 30-32 of the specification.

Although Abe et al. discloses a soldering flux containing an epoxy resin, this reference does not teach a polymer support member which comprises a cured droplet as in claim 32, or a polymer support member comprising cured polymer resin having a thickness less than the diameter of the solder ball as in claim 46, or a donut shaped polymer support member comprising cured polymer resin as in claim 53.

Rather in Abe et al. the soldering flux covers an area between a chip component and a printed substrate to secure the chip component to the substrate (column 4, lines 36-39). In other words, the soldering flux in Abe et al. is used in the manner of an underfill layer, rather than as individual polymer support members for external contacts as in the present system. In addition, the soldering flux in Abe et al. would completely fill the gap between the chip and the printed substrate, such that the thickness of the cured flux would be equal to or greater than the diameter of the external contacts. Further, the soldering flux in Abe et al. does not have a donut shape as in added claim 53.

In Glenn et al. a conventional flux is used (column 5, lines 45-46) but with a novel application method. However,

conventional fluxes are configured to substantially vaporize during the reflow process, such that a polymer support member would not remain as with the present system. The combination of Abe et al. and Glenn et al. thus does not disclose, suggest, or inherently achieve individual polymer support members.

Applicant would further argue that one skilled in the art would have no incentive to combine Abe et al. and Glen et al. in the manner of the Office Action. In this regard, the Office Action states the motivation as: "in order to provide a furnace as a reflow means, as taught by Glen et al., and to use a jig as a solder ball transfer mechanism, as taught by Glenn et al.".

However, furnace reflow is so well known in the art that the Abe et al. inventors would have likely known about it without the teachings of Glenn et al. In addition, there would be no reason to use a jig as a solder ball transfer mechanism in Abe et al., because the solder balls or bumps in Abe et al. appear to be already present on the component. In particular, as stated at column 4, lines 23-27 of Abe et al.: "After this solder paste is applied to an area to be soldered by printing or with a dispenser of the like, a chip component can be mounted thereon and reflow soldering can be carried out." The "reflow soldering" passage implies that bumps or balls on the chip or printed circuit substrate (column 4, lines 36-37) were already present.

In regard to motivation for the proposed combination the Office Action further states: "One of ordinary skill in the art would have been motivated to provide contact pads on the semiconductor package in order to provide means for an electronic connection between the package and the mounted devices". However, the chips in Abe et al. almost certainly had contact pads on the chips because this is the conventional mounting structure for solder balls or bumps.

35 USC §103 Rejections Of Claims 41-45 Over Abe et al. in view of Soderlund et al. and Glenn et al.

With respect to the rejections of claims 41-45, the cited combination of Abe et al., Soderlund et al., and Glenn et al. does not disclose all of the limitations of amended independent claims 41. In addition, the cited combination does not disclose all of the limitations of added independent claim 58.

In particular, amended independent claim 41 recites "a solder bump on the contact pad comprising coalesced solder particles in the droplet", and "a polymer support member on the contact pad comprising cured polymer resin in the droplet supporting the solder bump". Added independent claim 58 recites "a solder bump on the contact pad comprising coalesced solder particles in the droplet", and "a polymer support member on the contact pad comprising cured polymer resin in the droplet encompassing a base of the solder bump".

As previously argued, the combination of Abe et al., and Glenn et al. does not disclose a system having individual polymer support members formed by cured polymer resin in deposited droplets of flux. Further, the combination of Abe et al., and Glenn et al. does not disclose a system in which a polymer flux includes solder particles, which coalesce into solder bumps supported by polymer support members.

Soderlund et al. was cited as teaching a solder reflow furnace with a conveyor, and that the furnace will minimize the buildup of condensed flux. However, there is no teaching of the above noted features of individual polymer support members, or solder particles which coalesce into solder bumps supported by the polymer support members. In addition, although furnaces are well known in the art, the present system uses a furnace in combination with a polymer flux, polymer support members and coalesced solder bumps.

Applicant would further argue that one skilled in the art would have no motivation for the proposed combination of Abe et al., Soderlund et al. and Glenn et al., essentially for the same reasons as argued above.

Conclusion

In view of the arguments and amendments favorable consideration and allowance of amended claims 32-52 and added claims 53-62 is respectfully requested. An Information Disclosure Statement is being filed concurrently with this Amendment. Should any issues arise that will advance this case to allowance, the Examiner is asked to contact the undersigned by telephone.

DATED this 4th day of August, 2003.

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August 4, 2003
Date of Signature

Stephen A. Gratton, Attorney for Applicants